GREEN SYNTHESIS OF COPPER NANOPARTICLES

***Version 1.0***

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# OBJECTIVE

To prepare copper nanoparticles from copper sulfate and ascorbic acid.

# REQUIREMENTS

To follow this tutorial, it is necessary to have training in: weighing on a precision balance.

# SOFTWARE REQUIREMENTS

None.

# STEP BY STEP

* 1. PREPARATION OF SOLUTIONS

To prepare copper nanoparticles, it is necessary to prepare two base solutions. To generate them, you will need 5g of copper sulfate and 7.5g of ascorbic acid. Make sure you have these materials before following the procedure. For your safety, wear gloves and do not ingest any of the resulting elements or solutions.

1. Obtain two glass beakers of at least 200 mL.
2. Deposit 750 mL of water in each of them. Make sure all the water is at the bottom of the container and not adhered to the walls.
3. Weigh 7.5 g of ascorbic acid in a ceramic container.
4. Deposit the ascorbic acid in one of the beakers with water.
5. Stir until obtaining a homogeneous and translucent solution as shown in Figure 1. Properly label the beaker with a tag.



Figure 1: Ascorbic acid solution in water.

1. Weigh 5g of copper sulfate in a ceramic container.
2. Deposit the copper sulfate in the beaker with the remaining water. Properly label the beaker with a tag.
3. Stir until obtaining a homogeneous and blue-colored solution as shown in Figure 2. Note that the container in which you make this solution will be the container in which you obtain and store the copper nanoparticles to avoid losing them when transferring them to another container*.*



Figure 2: Copper sulfate solution in water.

## PREPARATION OF COPPER NANOPARTICLES

1. Vigorously stir the copper sulfate solution while slowly adding the ascorbic acid solution. You will notice that the solution changes from blue to green. This is due to the displacement of copper ions caused by iron ions. The solution should look like the one shown in Figure 3.



Figure 3: Resulting solution when mixing ascorbic acid with copper sulfate. Stir vigorously for approximately 1 minute.

1. Cover the container to prevent contamination.
2. Let the solution rest for at least an hour. You will notice a pink layer at the bottom of the container as shown in Figure 4.



Figure 4: Separation of copper nanoparticles (pink bottom layer) from ascorbic acid solution (green).

1. The bottom layer contains the copper nanoparticles.
2. Remove the green solution resulting from ascorbic acid to access the particles. Keep in mind that the copper nanoparticles will begin to oxidize immediately after removing the solution that covers them.

# CHANGE CONTROL

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